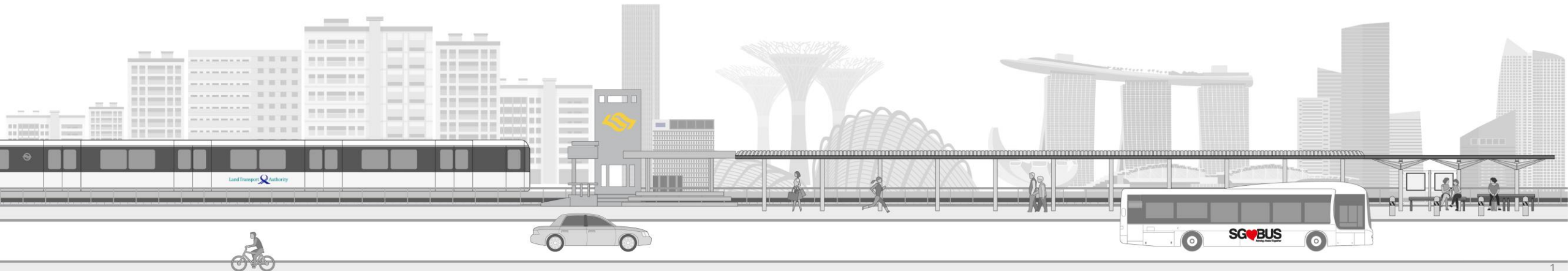


Mobility Transformation in Singapore - with a Focus on Railway Policy

Er. Chua Chong Kheng

Deputy Chief Executive, Infrastructure & Development

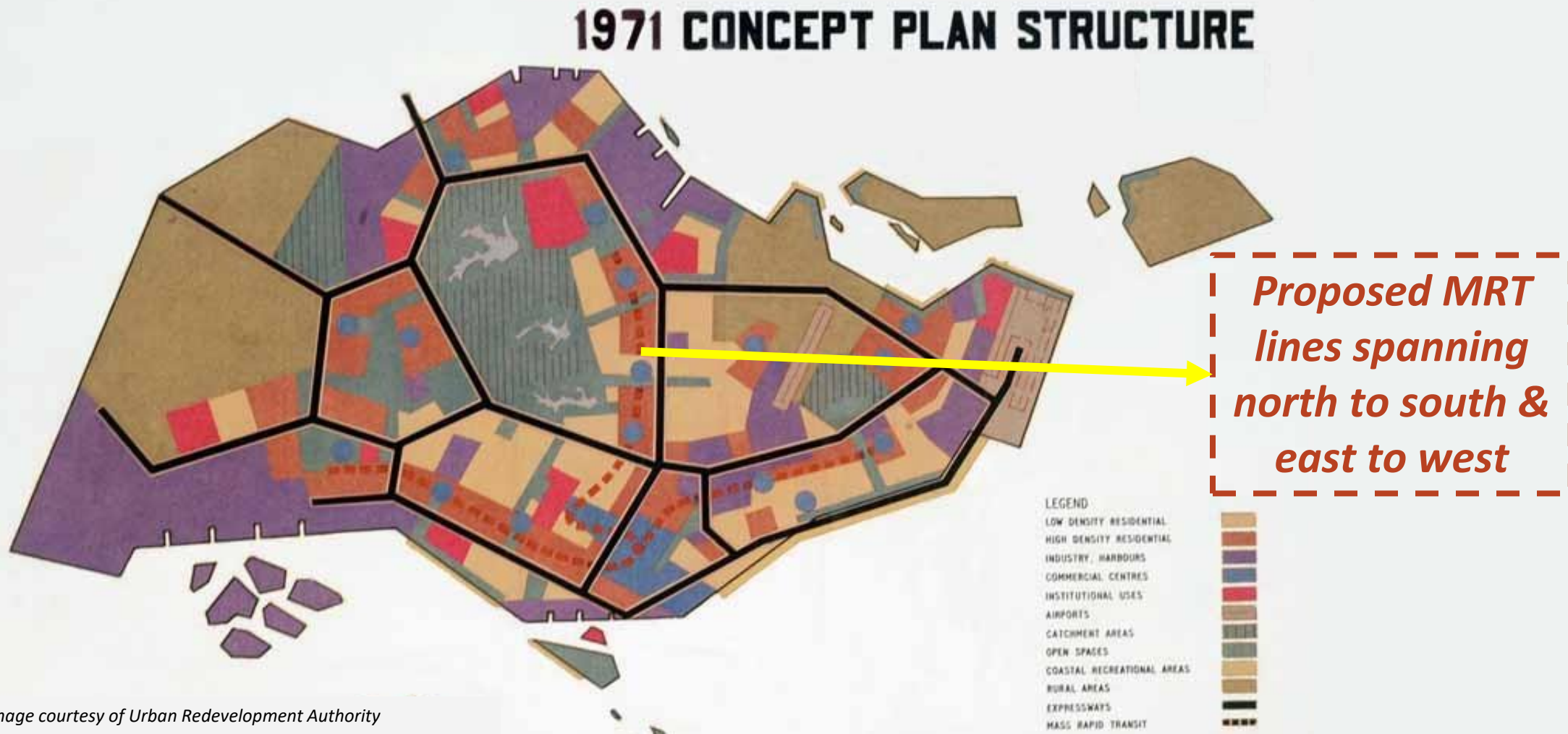
Land Transport Authority of Singapore



First Concept Plan

- Developed to guide Singapore's long-term development
- Proposed MRT as backbone of the public transport system

1970

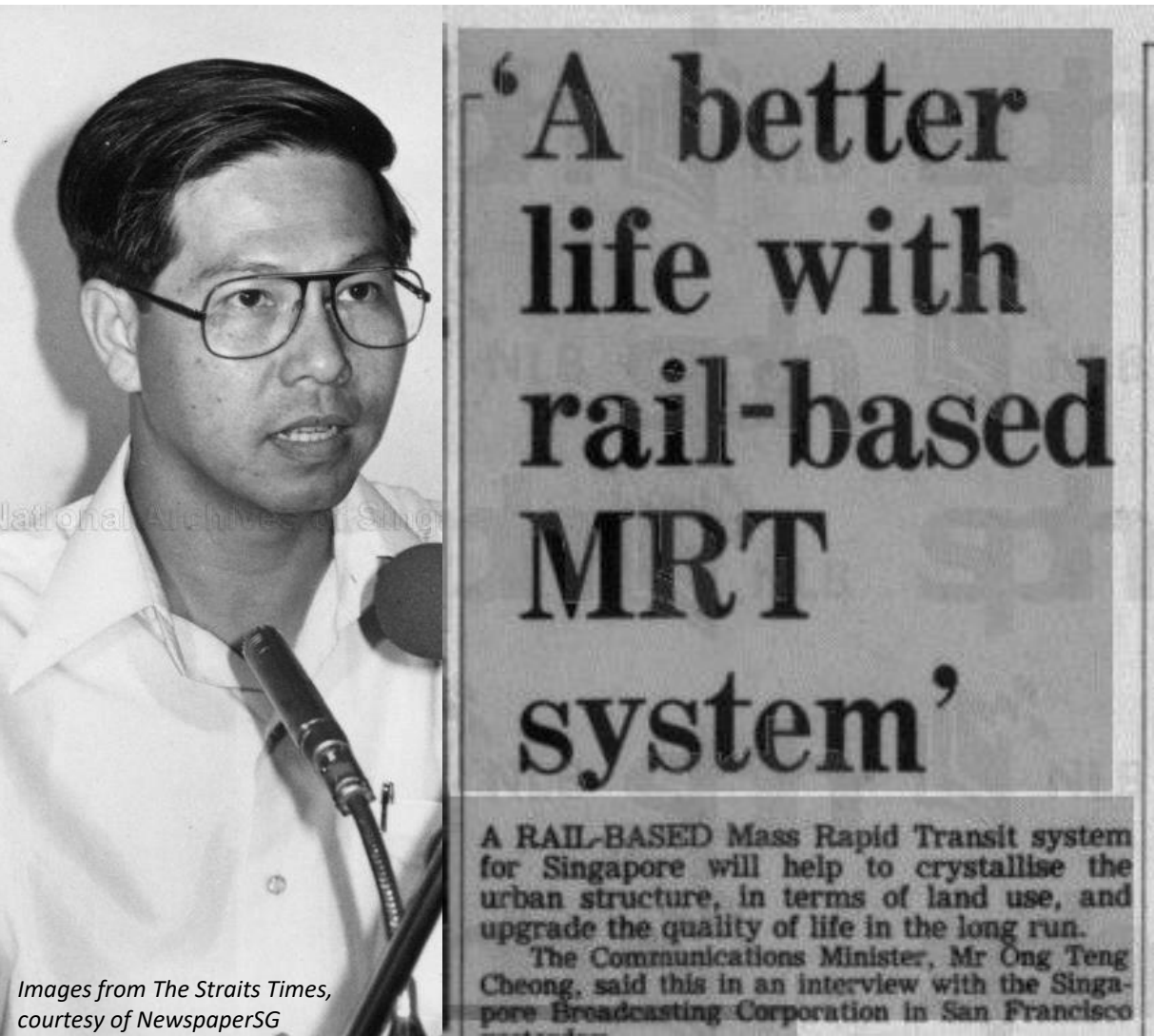


The Great MRT Debate

- Due to large estimated cost for MRT construction, it faced opposition that an all-bus system would be sufficient and more cost-effective.

1970

1980



The Great MRT Debate

- The reclamation of Marina South tilted the debate in favour of building the MRT.

The only way you can get to Marina South is through a road by the side of Telok Ayer Basin. If you have MRT going to Marina South, then that open space can be developed.

Mr Ong Teng Cheong, Minister for Communications

1970

1980



MRT Construction

- The government gave the go-ahead for MRT construction in 1982.
- First section of **North-South Line** was completed on 7 November 1987.



1970

1980

First Two MRT Lines

- The **North-South** and **East-West Lines** were completed on 6 July 1990, within the approved budget of S\$5 billion.

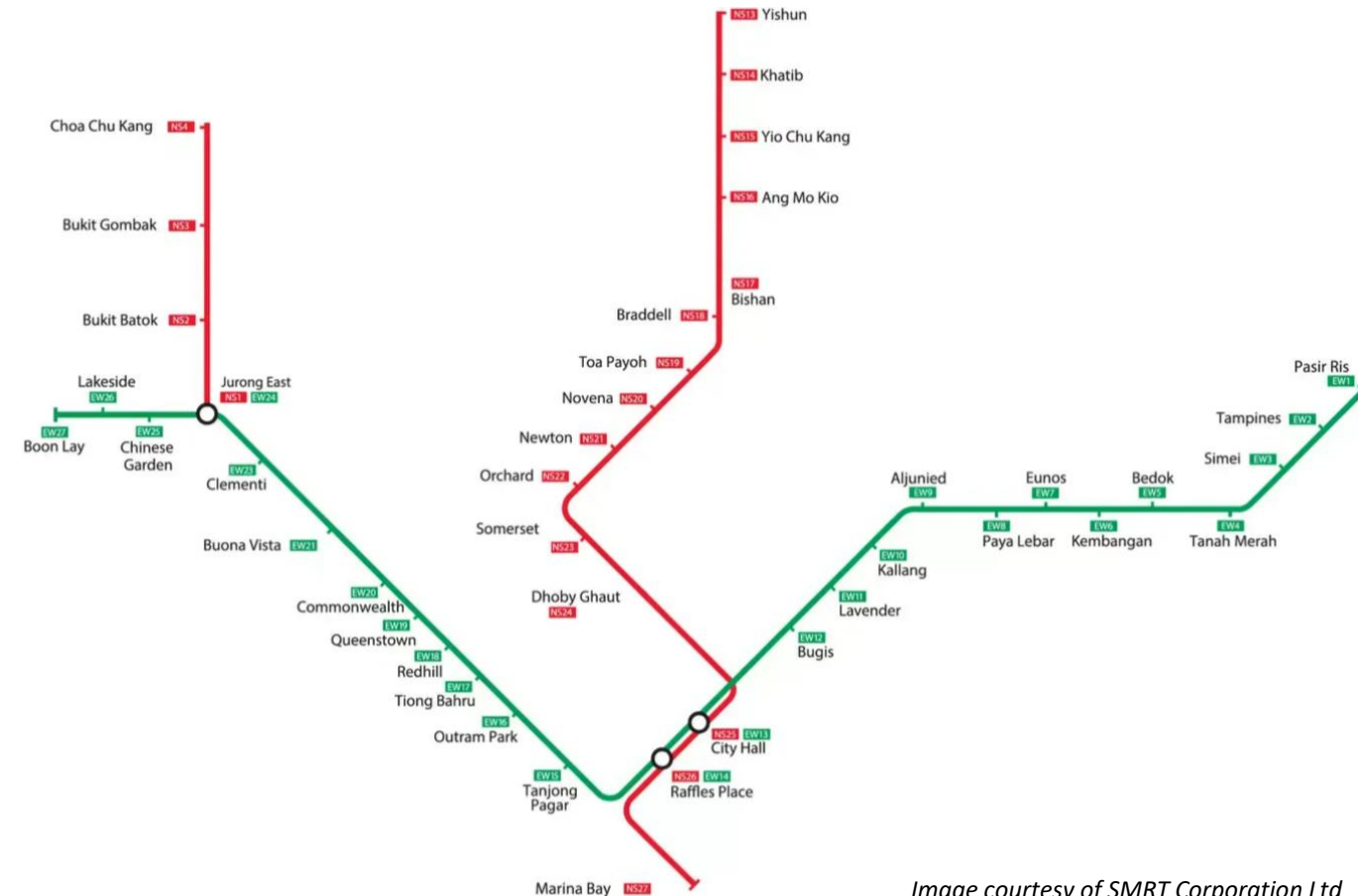


Image courtesy of SMRT Corporation Ltd



NSEWL MRT Network

NSEWL MRT Train

1970

1980

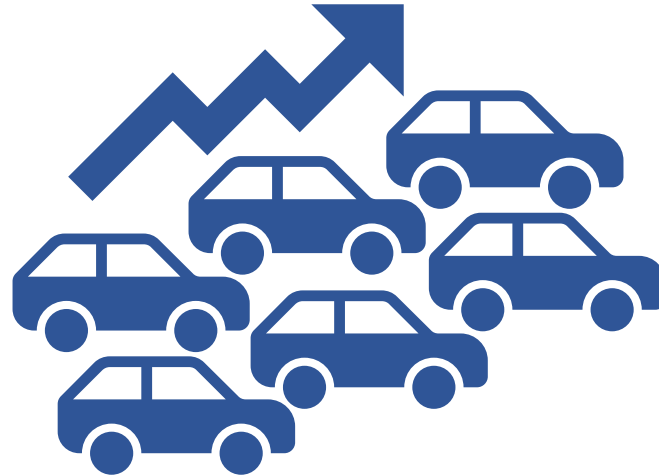
1990

Establishment of Land Transport Authority

- The Land Transport Authority was established on 1 September 1995 to adopt a holistic approach to emerging land transport challenges.



**Increase in
Transport Demand**



**Increase in
Car Population**



**Rising Expectations for
Quality Transport**

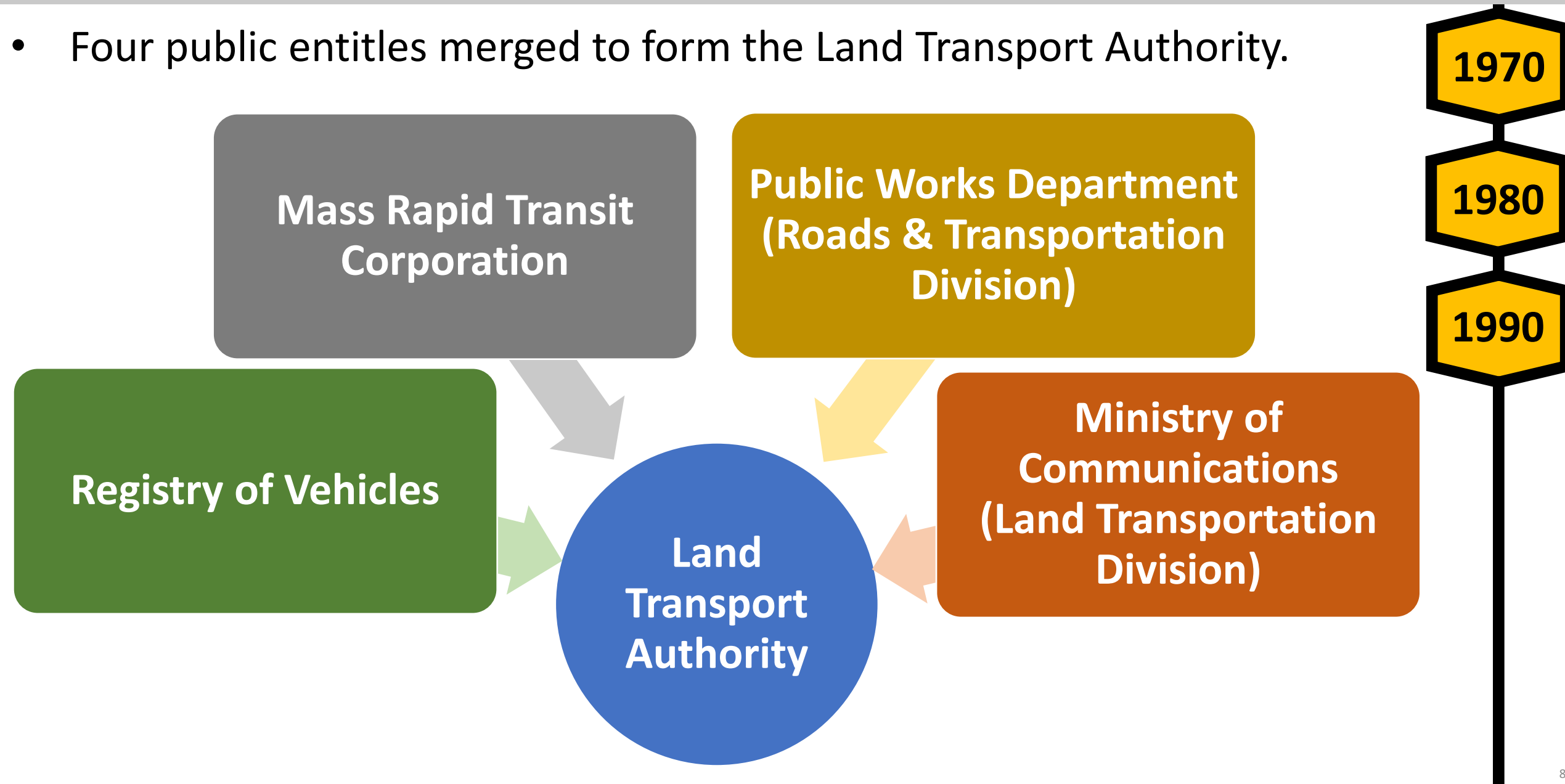
1970

1980

1990

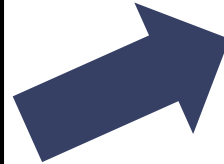
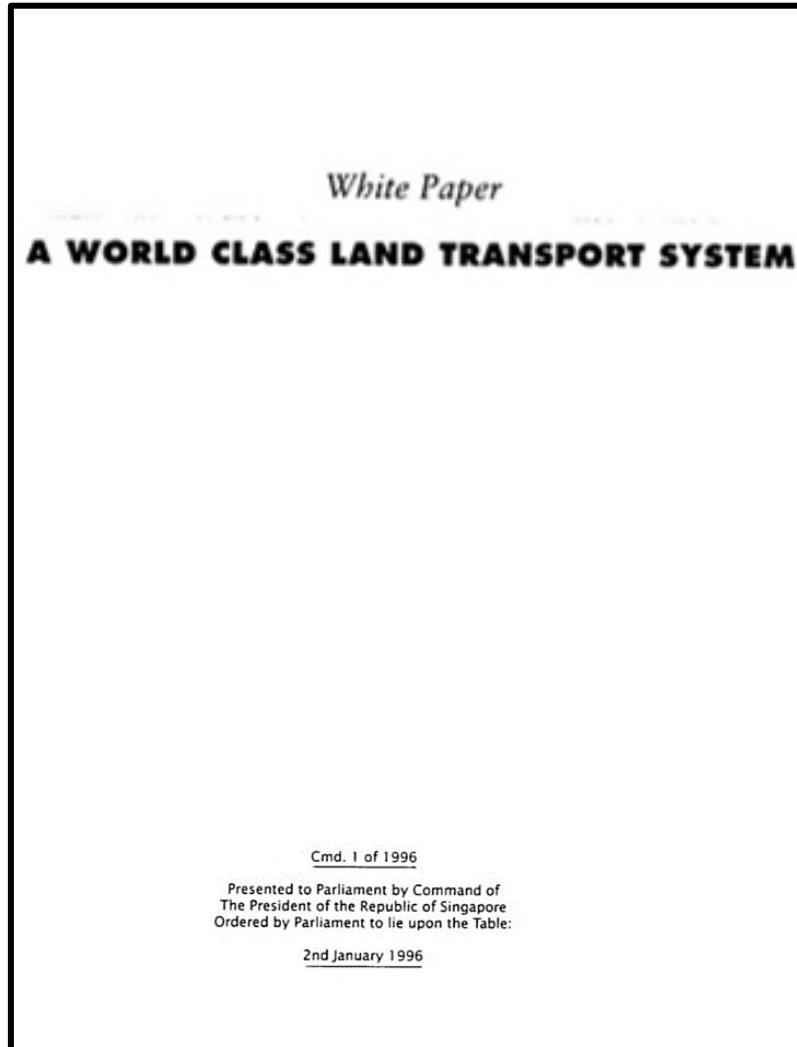
Establishment of Land Transport Authority

- Four public entities merged to form the Land Transport Authority.



White Paper 1996

- LTA published a White Paper in 1996, detailing the vision to achieve a World Class Land Transport System.



**Financing
Framework**



**Initiatives to Improve
Public Transport
System**

1970

1980

1990

White Paper (Financing Framework)

- The White Paper set out three key principles for financing framework.

1 Fares have to be realistic and regularly revised to account for justifiable cost increases.

2 The services must at least recover operating cost.

3 Provision for depreciation and asset replacement must be adequate.

1970

1980

1990

White Paper (Financing Framework)

1

Fares have to be realistic and regularly revised to account for justifiable cost increases.



Better Rides • Affordable Fares • Sustainable Public Transport



**Independent body to regulate
public transport fares**

**Comprises members from a wide
cross-section of society**

1970

1980

1990

White Paper (Financing Framework)

1

Fares have to be realistic and regularly revised to account for justifiable cost increases.

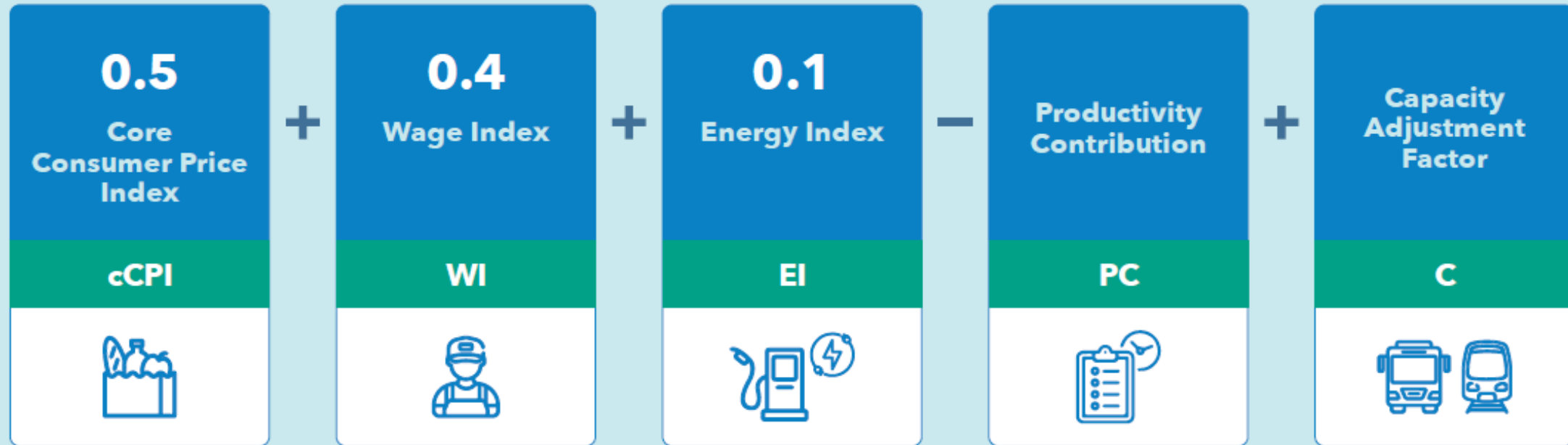


Image courtesy of Public Transport Council

Fare Adjustment Formula (2023 – 2027)

1970

1980

1990

White Paper (Financing Framework)

2

The services must at least recover operating cost.

Viability of New Rail Lines

Economic Viability

Cost

Benefit

Financial Viability

Cost

Revenue

1970

1980

1990

White Paper (Financing Framework)

3

Provision for depreciation and asset replacement must be adequate.

Historical Cost
of First Set of
Operating
Asset



Increase in Cost
due to Inflation



Cost of
Second Set of
Operating
Assets

Fare Revenue

*Co-financing from
Government*

1970

1980

1990

White Paper (Improving Public Transport)

- The White Paper introduced two key strategies to improve the public transport system.

Key Strategies

**Integrated Land Use &
Transport Planning**

**Expanding Rail
Network (Backbone
of Transport System)**

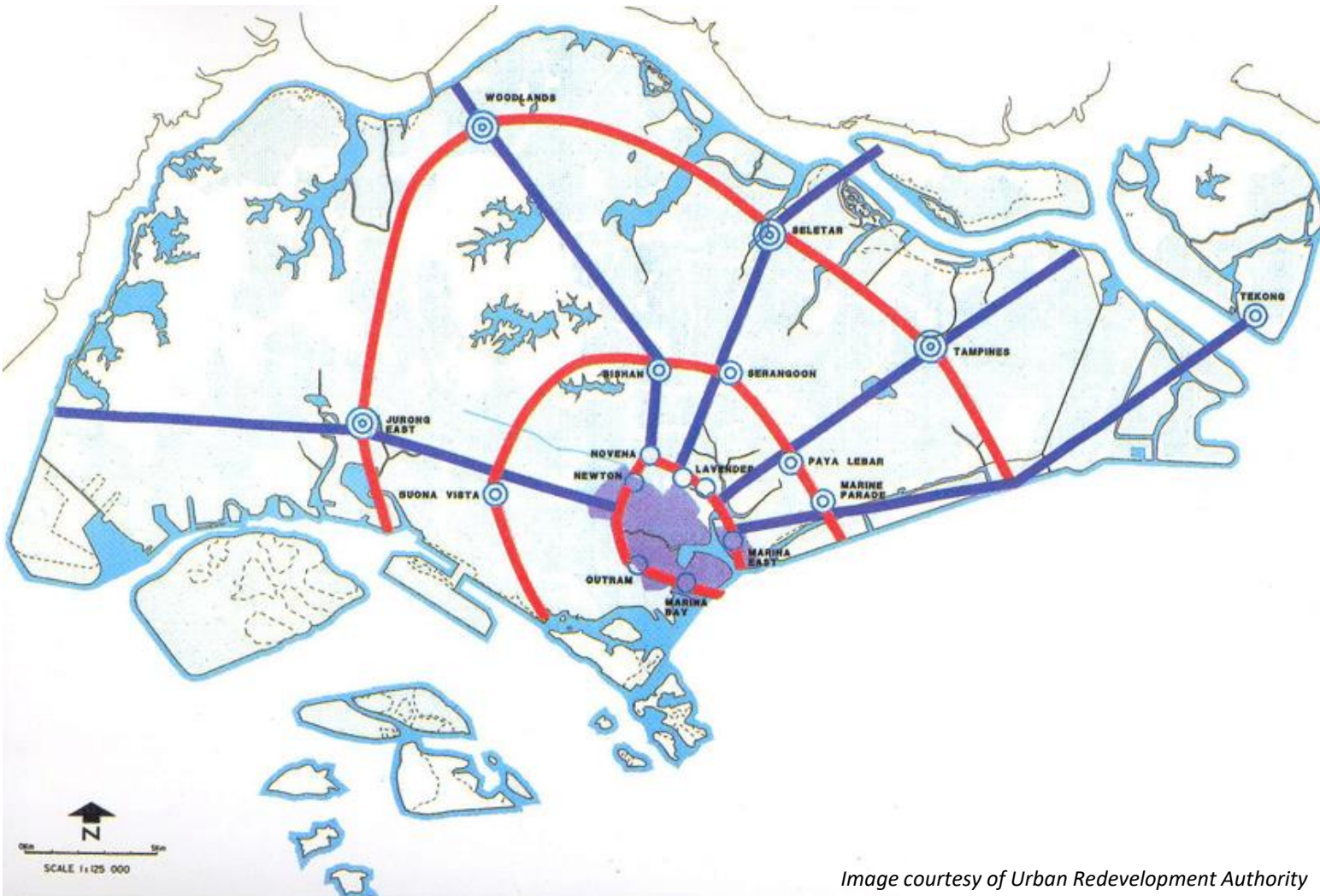
1970

1980





1990

Integrated Land Use & Transport Planning

- Concept Plan 1991 adopted a “Constellation Concept” to decentralise commercial and other activities, while supported by the rail network.



Legend

-  Mass Transit Corridor - Radial
-  Mass Transit Corridor - Circumferential
-  Regional Centre
-  Sub-regional Centre

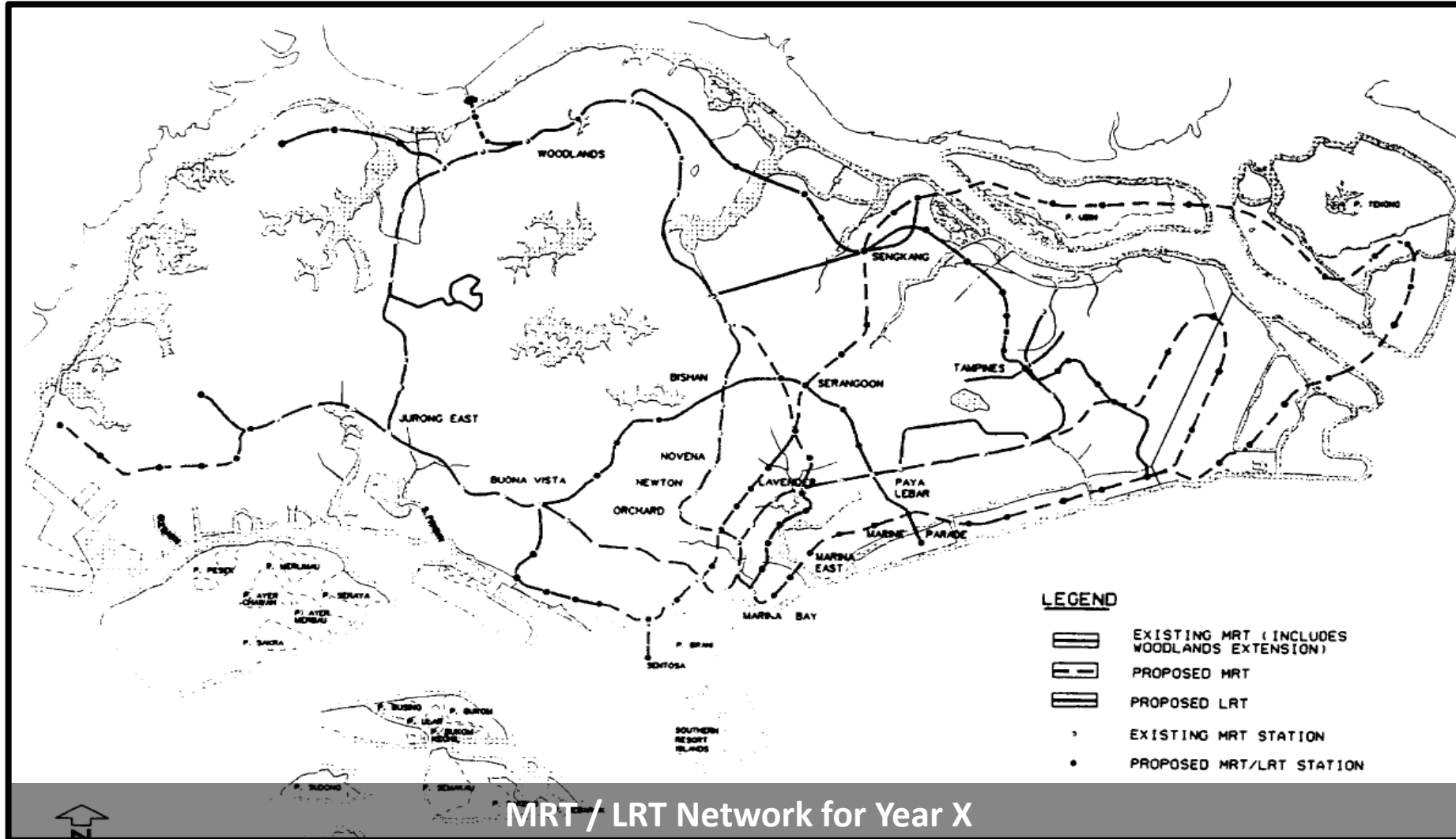
1970

1980

1990

Expanding Rail Network

- The White Paper planned for a rail network of at least 160km in the long term, to serve as the backbone of our public transport network.

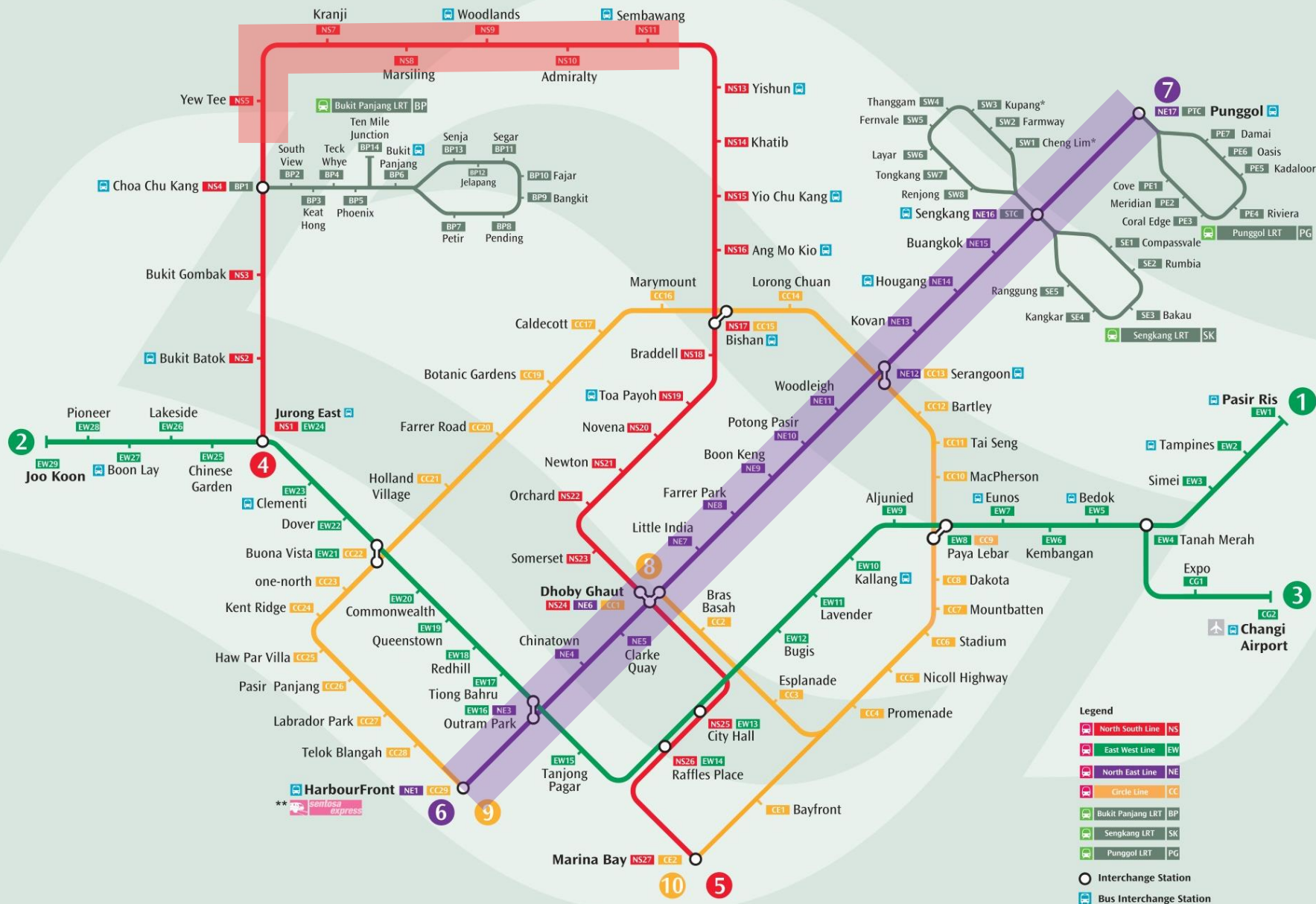


1970

1980

1990

Expanding Rail Network



Woodlands Extension was built to serve the regional centre.

North East Line was built to serve the regional centre.

1970

1980

1990

Expanding Rail Network



Circle Line was built to serve the sub-regional centres.

Light Rail Transit (LRT) was built to serve corridors with lighter traffic.

1970

1980

1990

Fully Automated Driverless System

- North East Line is the world's first fully automated underground driverless heavy rail rapid transit line.

Benefits

Address challenge in recruiting
Passenger Train Operators

Provide flexibility to
introduce or withdraw trains

Minimise error in
human intervention



1970

1980

1990

Entry of Second Multi-modal Operator

- Competitive tendering was adopted for North East Line and Sengkang and Punggol LRTs, leading to entry of second multi-modal operator.



**North-South
Line**

**East-West
Line**

**Circle
Line**

**Thomson-East
Coast Line**

**Bukit Panjang
LRT**



**North East
Line**

**Downtown
Line**

**Sengkang
LRT**

**Punggol
LRT**

1970

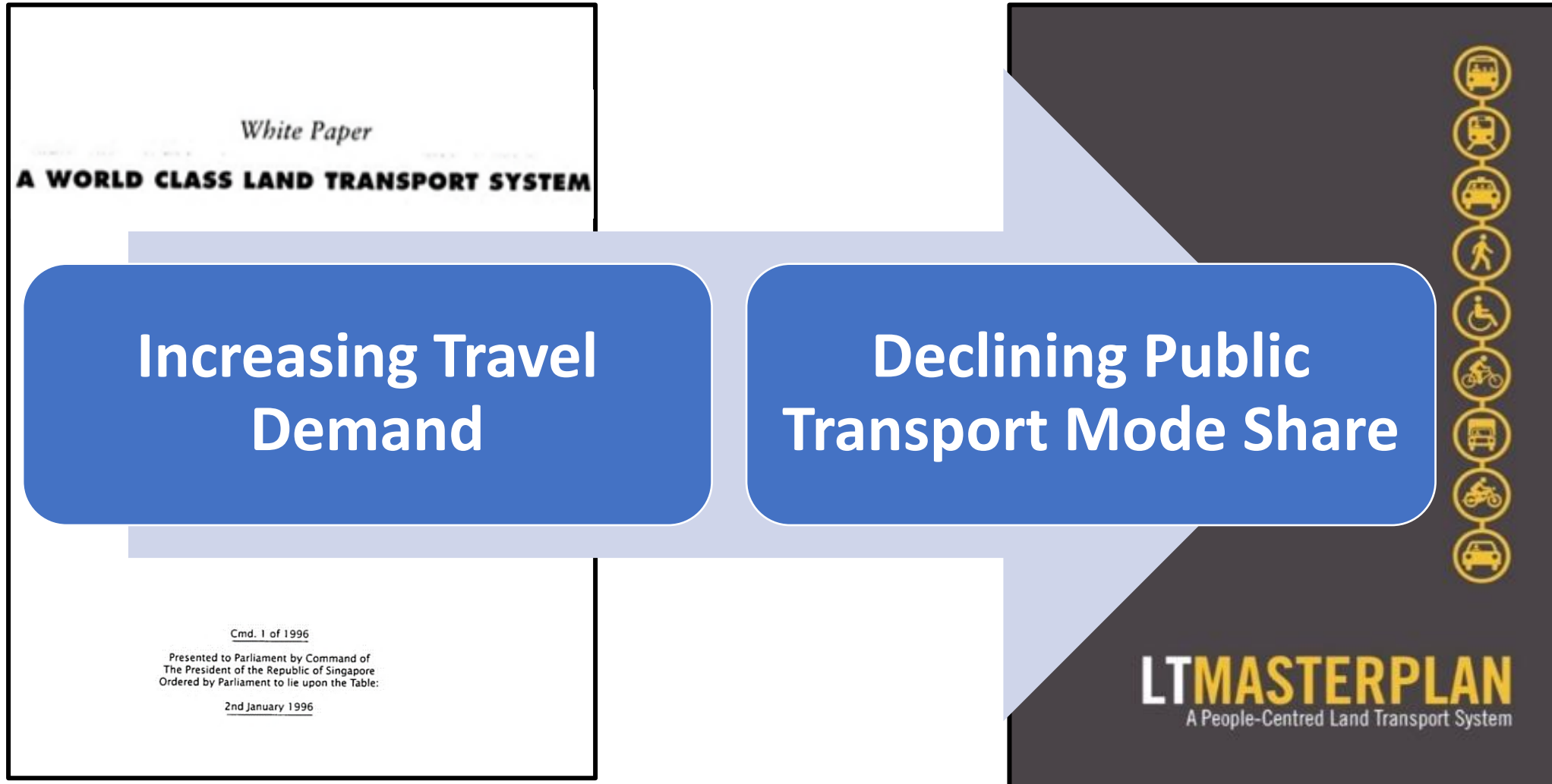
1980

1990

Info accurate as of 2023

Land Transport Master Plan 2008

- Due to new challenges, LTA released Land Transport Master Plan 2008, focusing on a “People-Centred Land Transport System”.



1970

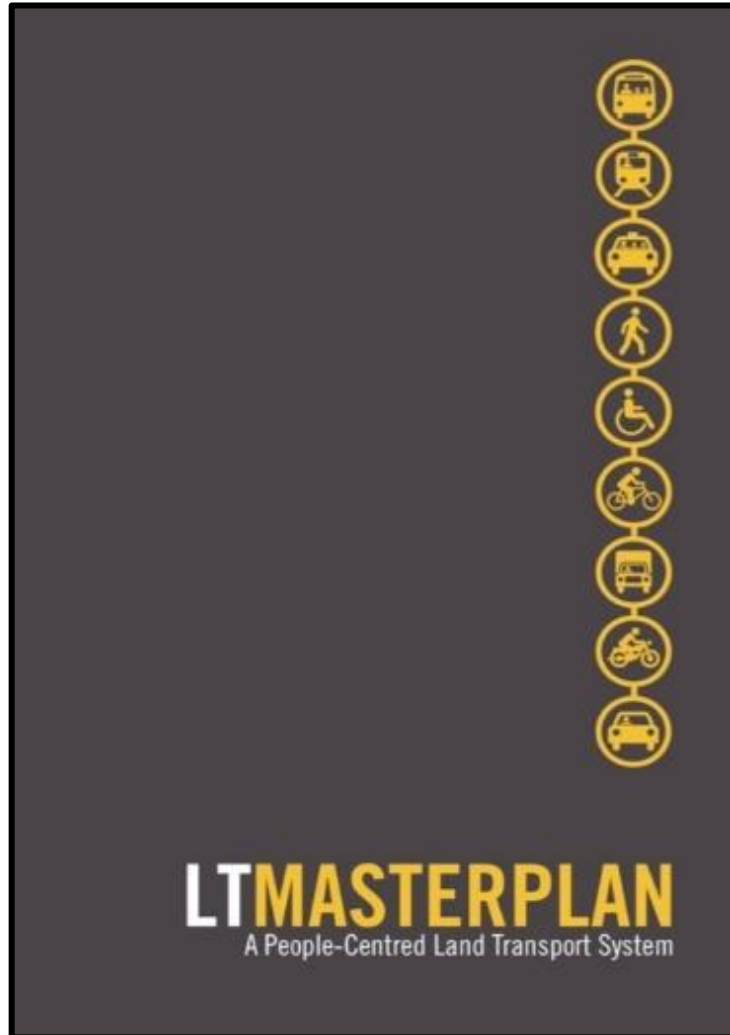
1980

1990

2000

Land Transport Master Plan 2008

- Due to new challenges, LTA released Land Transport Master Plan 2008, focusing on a “People-Centred Land Transport System”.



Key Targets for 2020

85%

of public transport journeys
(less than 20km) completed
within 60 minutes

70%

of all journeys in peak hours
undertaken on public
transport

1970

1980

1990

2000

Land Transport Master Plan 2008

Key Strategies

- a** Double Rail Network by 2020
- b** Enhance Rail Capacity by Increasing Train Frequency
- c** New Rail Financing Framework
- d** Central Bus Network Planner

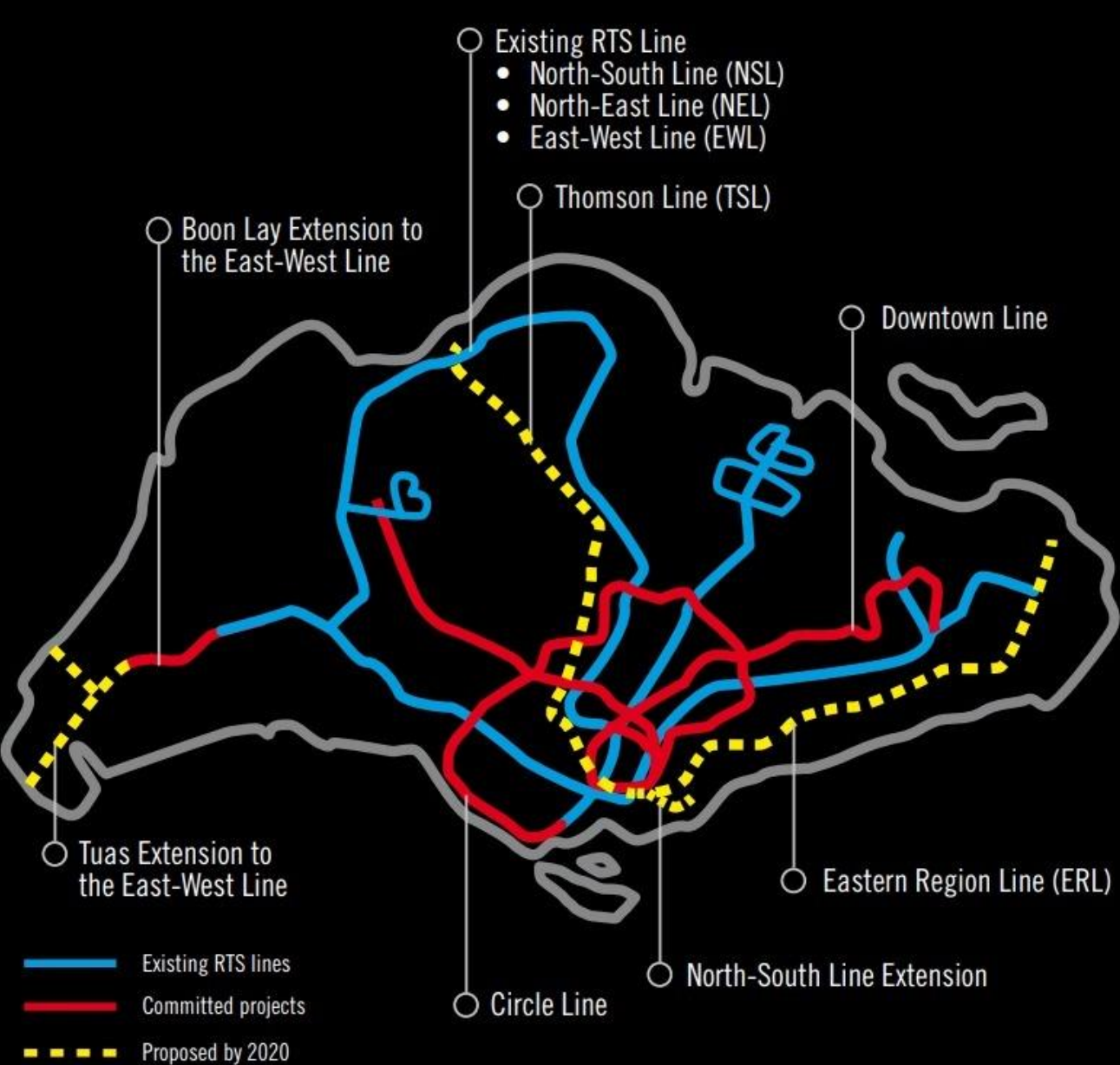
1970

1980

1990

2000

Double Rail Network by 2020



1970

1980

1990

2000

Increasing Train Frequency

1

- **Revise Operating Performance Standards to prescribe minimum train headways**

2

- **Invest in Additional Trains**

3

- **Modification to Signalling System**

1970

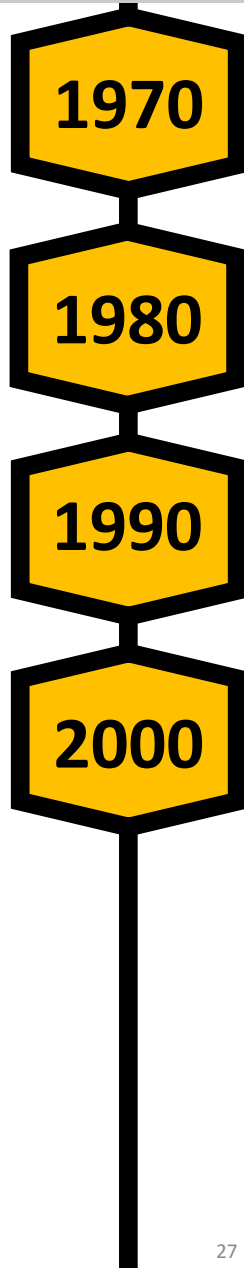
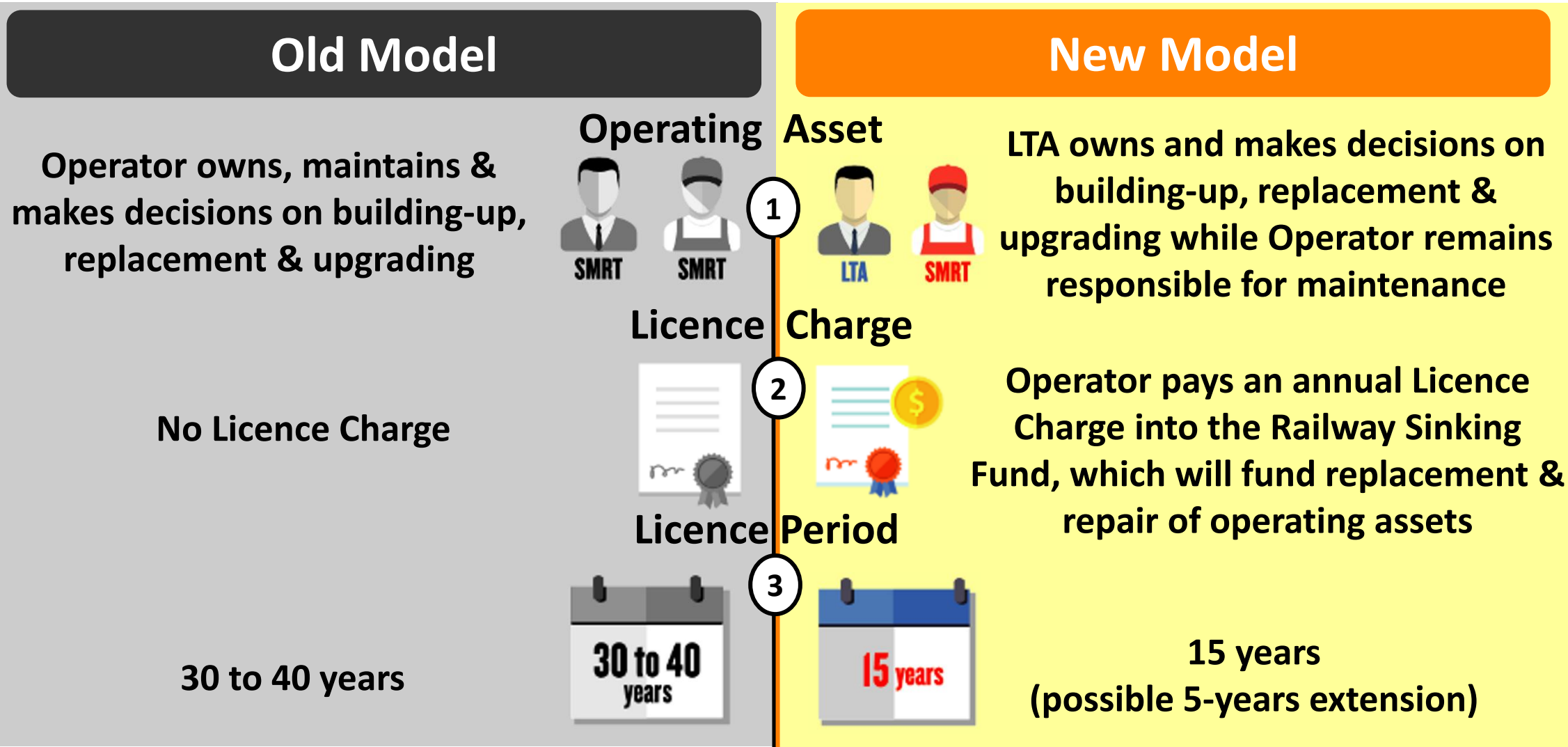
1980

1990

2000

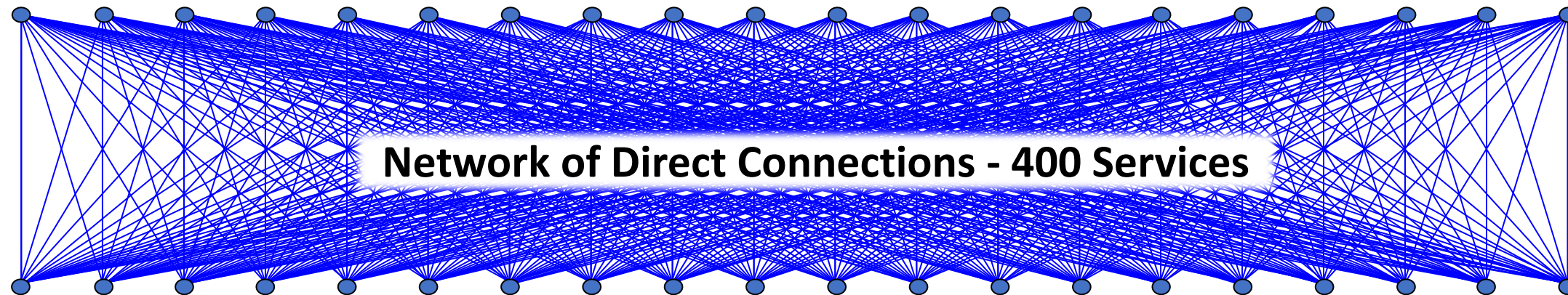
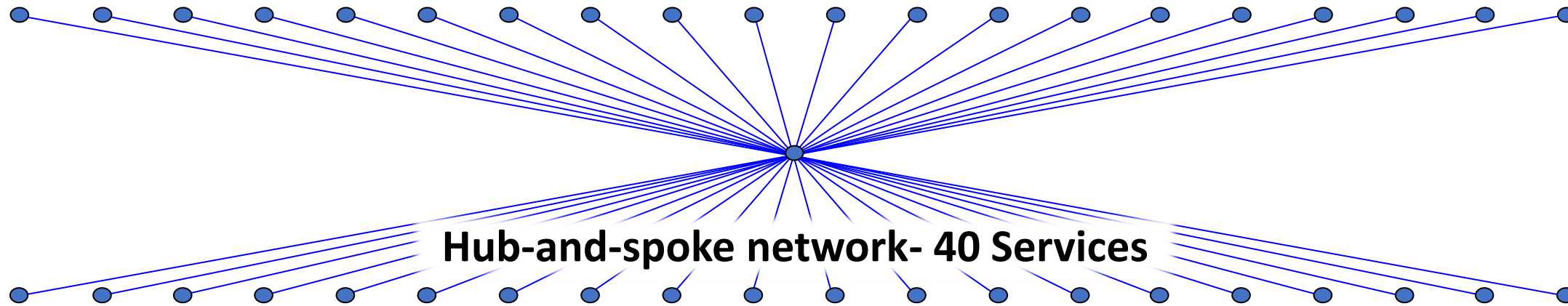
New Rail Financing Framework

- The Downtown Line is the first MRT line to come under the New Rail Financing Framework.



Central Bus Network Planner

- LTA took on the role of central bus network planner to enhance the hub-and-spoke model, reinforcing MRT as backbone of our network.



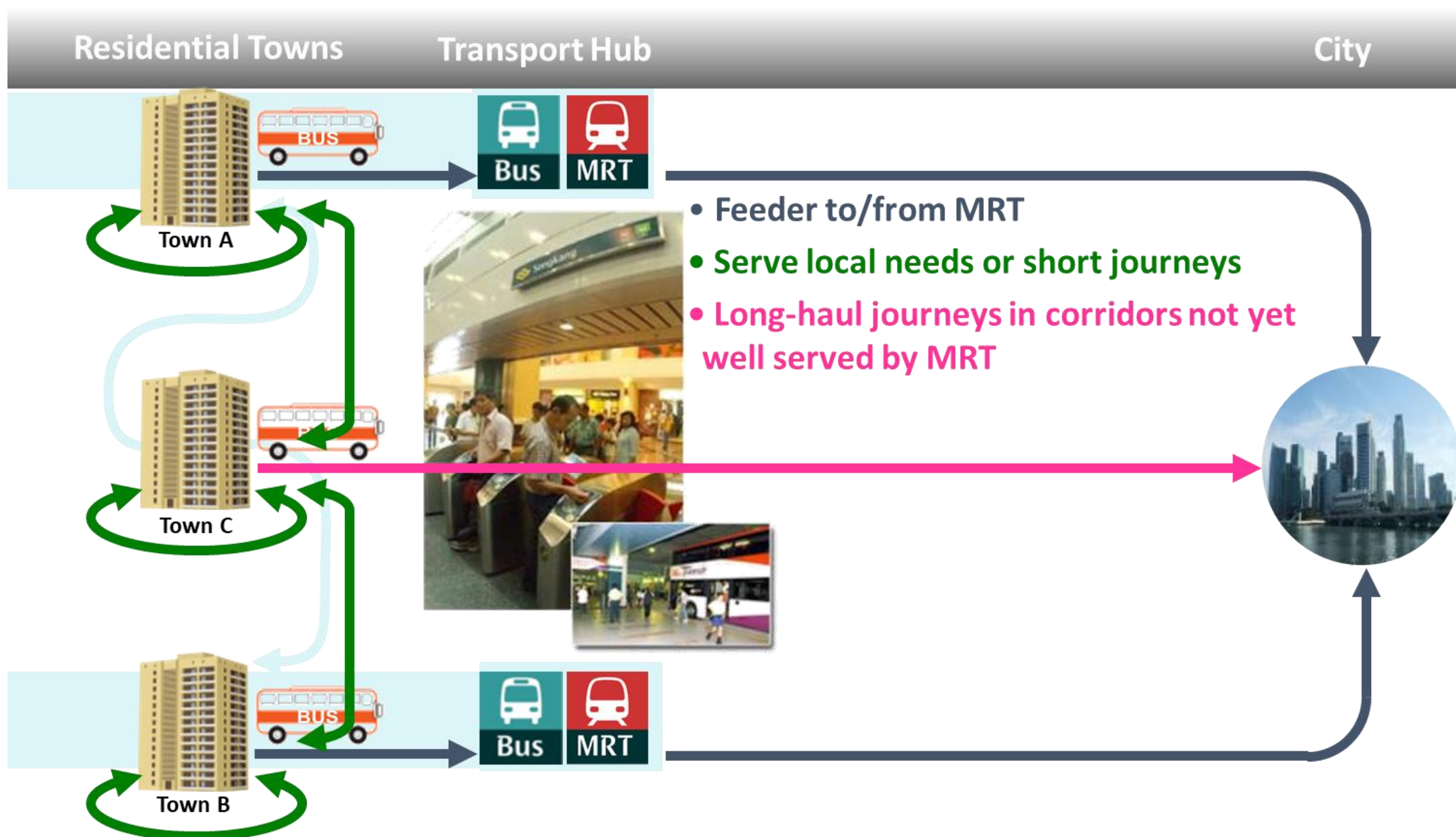
1970

1980

1990

2000

Central Bus Network Planner



1970

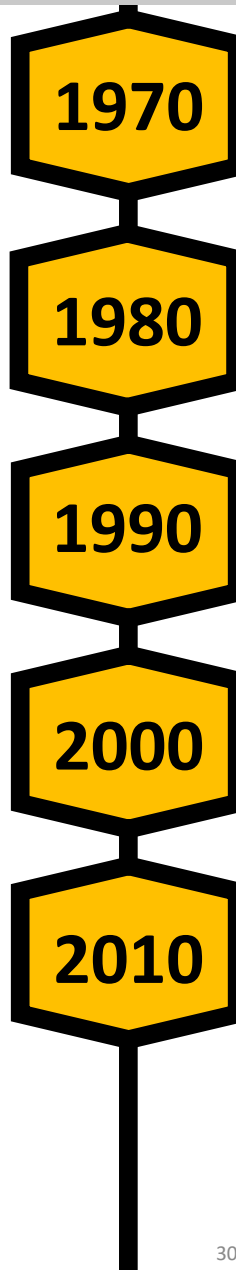
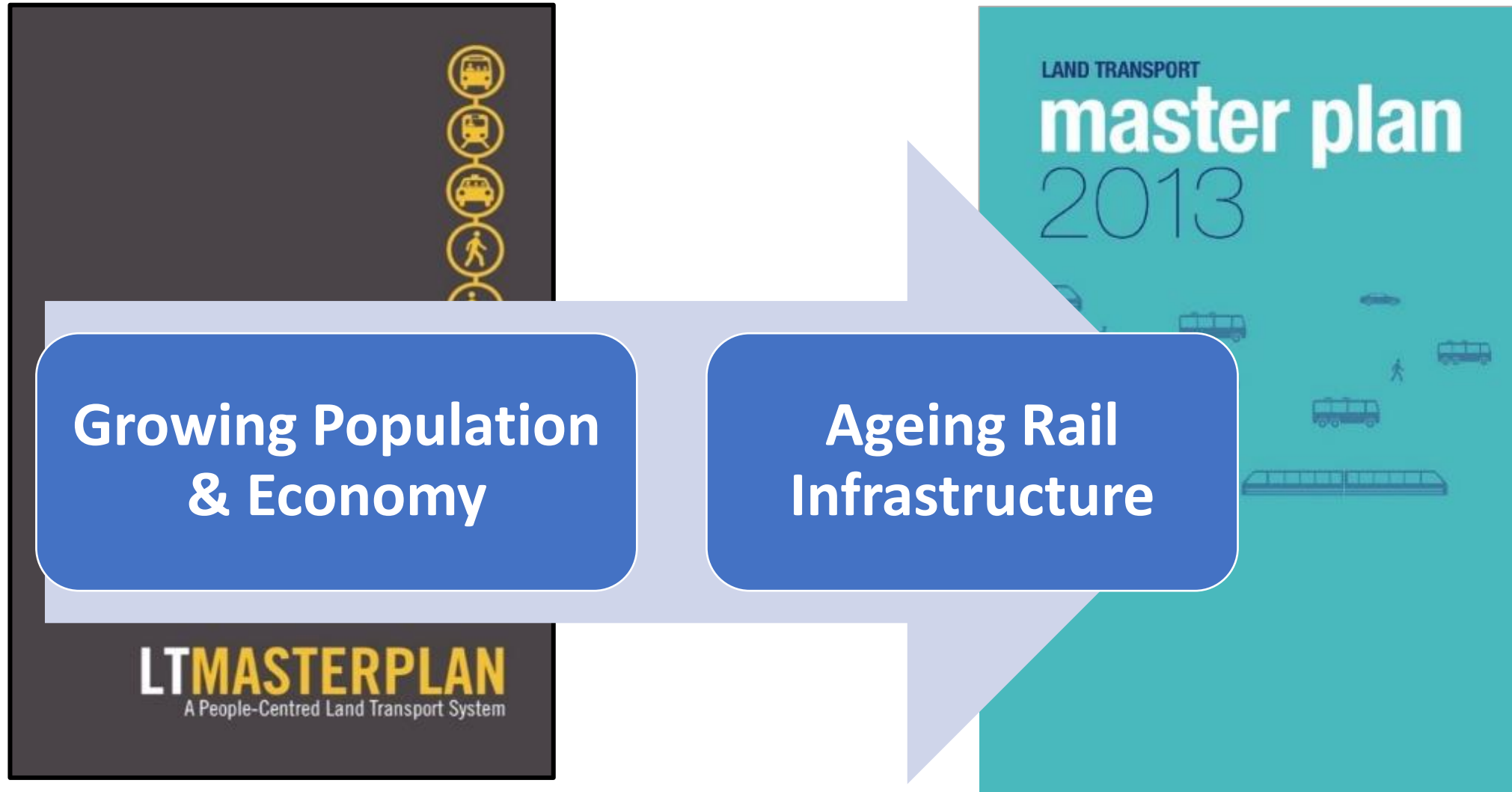
1980

1990

2000

Land Transport Master Plan 2013

- As new considerations emerged, LTA released Land Transport Master Plan 2013, focusing on “Enhancing Your Travel Experience”.



Land Transport Master Plan 2013

Key Targets for 2030

8 in 10

households living within
a 10-minute walk from a
train station

85%

of public transport journeys
(less than 20km) completed
within 60 minutes

75%

of all journeys in peak hours
undertaken on public
transport

Key Strategies

a

**Expanding Rail
Network**

b

**Enhancing Rail
Reliability**

1970

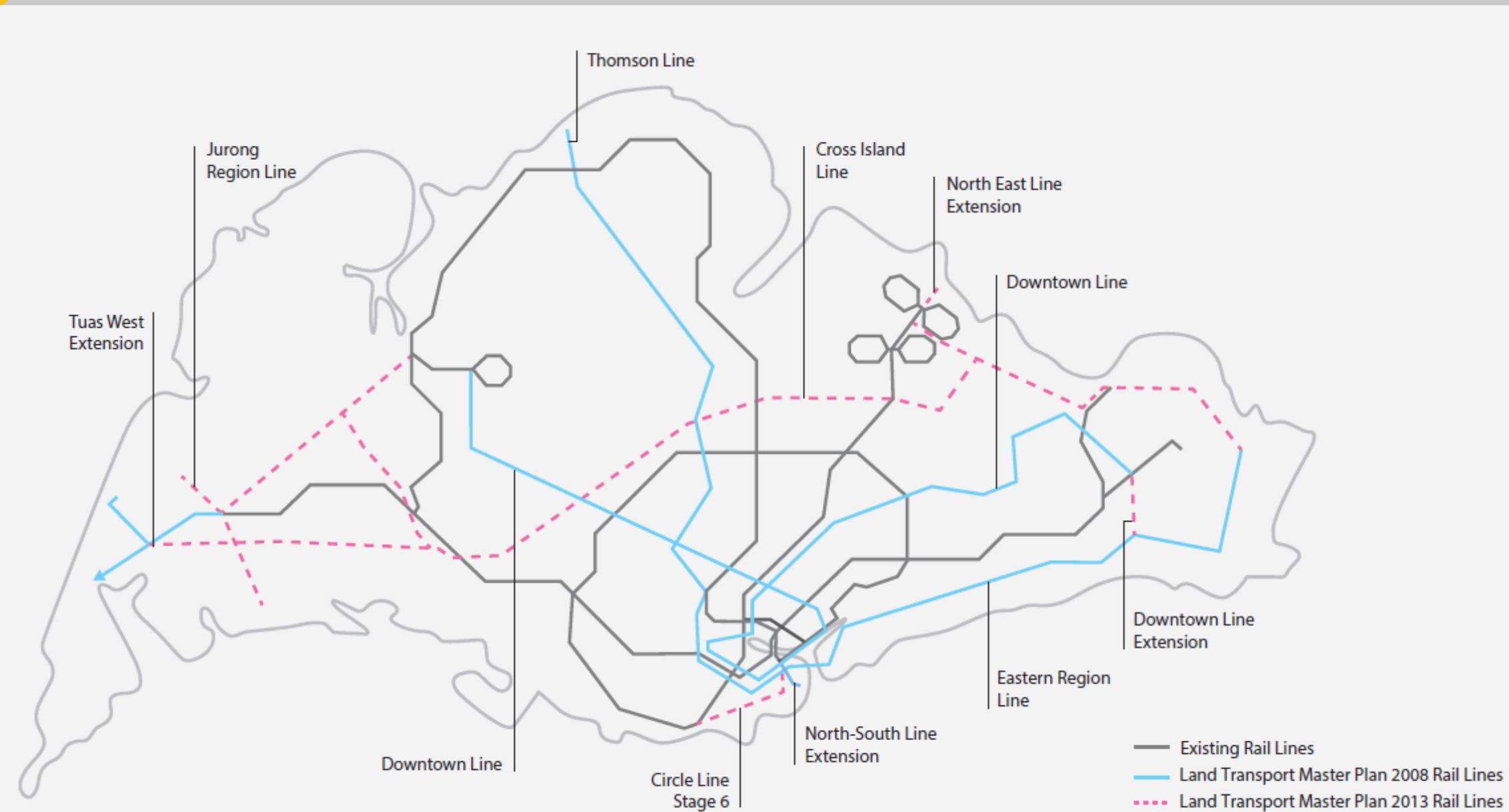
1980

1990

2000

2010

Expanding Rail Network



1970

1980

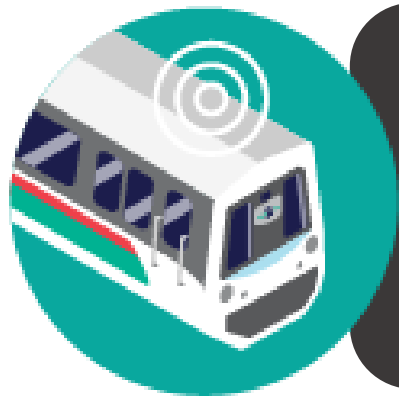
1990

2000

2010

Enhancing Rail Reliability

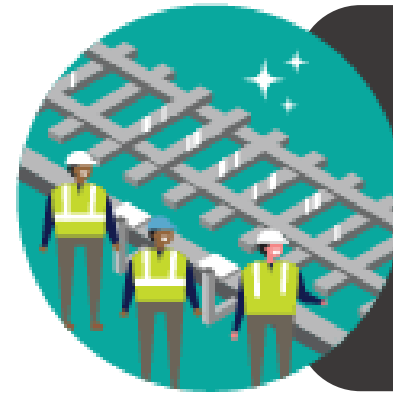
- We embarked on a major upgrading programme for North-South and East-West Lines from 2012 to 2023.



**New
Signalling
System**



**Replacement
of Sleepers**



**New
Third
Rail**



**New
Power
Supply
System**



**New
Track
Circuit
System**



**New
Trains**

1970

1980

1990

2000

2010

Enhancing Rail Reliability

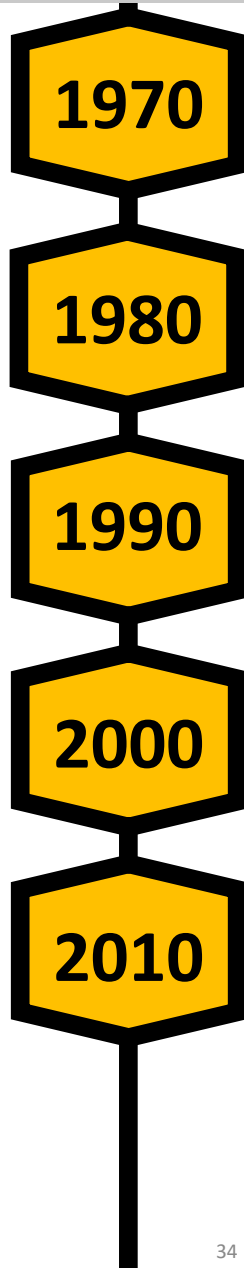
- The MRT network maintained over 1,000,000 MKBF since 2019.
- The Rail Reliability Incentive (RRI) aims to incentivise Operators to improve reliability of train services.



**1,000,000 Mean Kilometres
Before Failure (MKBF)**

MKBF measures how far a train travels before a delay of over 5 minutes.

MKBF is an internationally recognised indicator for rail reliability and adopted by the Community of Metros (COMET).



Land Transport Master Plan 2040

- To prepare Singapore's rail network for the future, LTA released Land Transport Master Plan 2040, with planning horizon up to 2040.



Commuters'
Aspirations

Sustainability

Digitalization &
Automation



1970

1980

1990

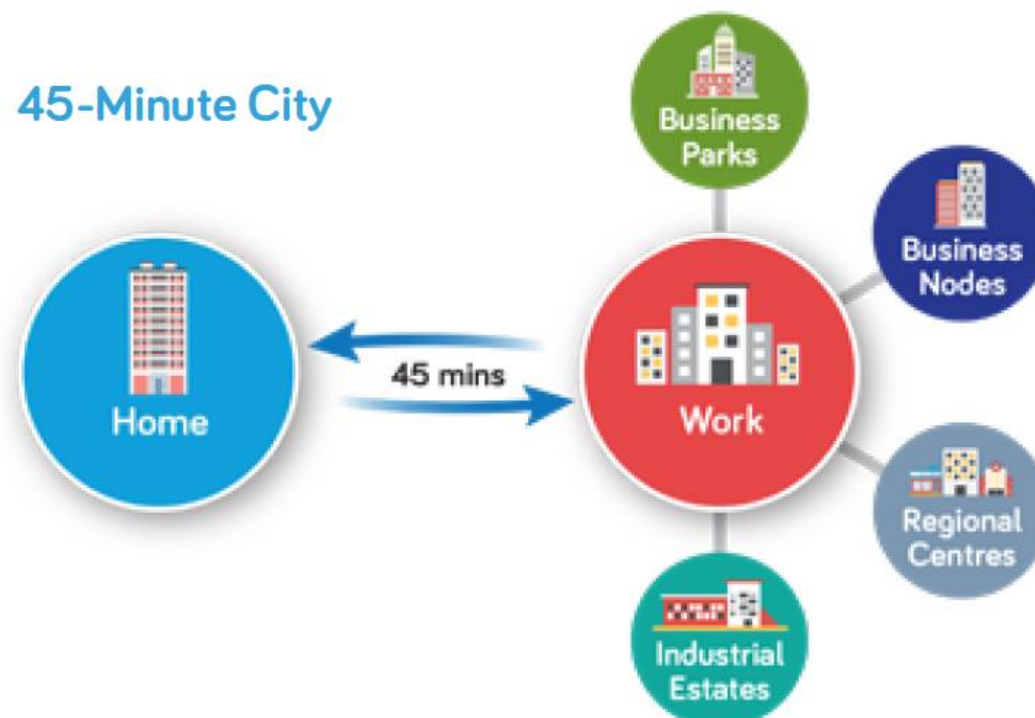
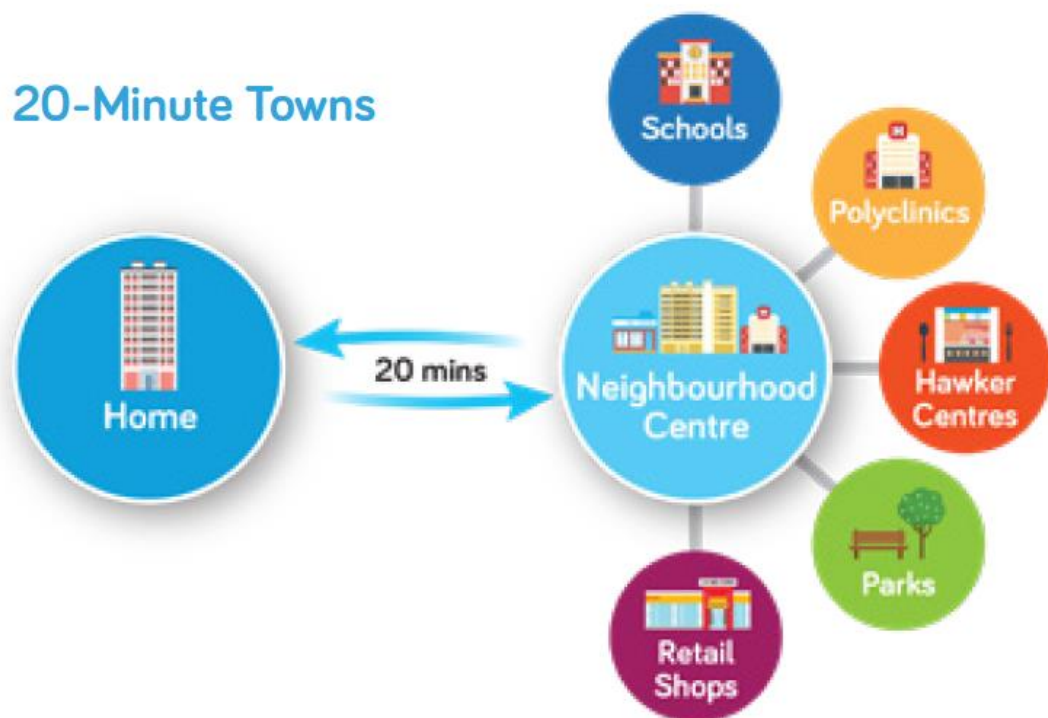
2000

2010

2020

Land Transport Master Plan 2040

- We envision a Singapore made up of 20-minute towns within a 45-minute city which is aligned with commuters' aspirations.
- Rail network expansion plans are underway to achieve marked reduction in travel times.



1970

1980

1990

2000

2010

2020

Current Lines



1970

1980

1990

2000

2010

2020

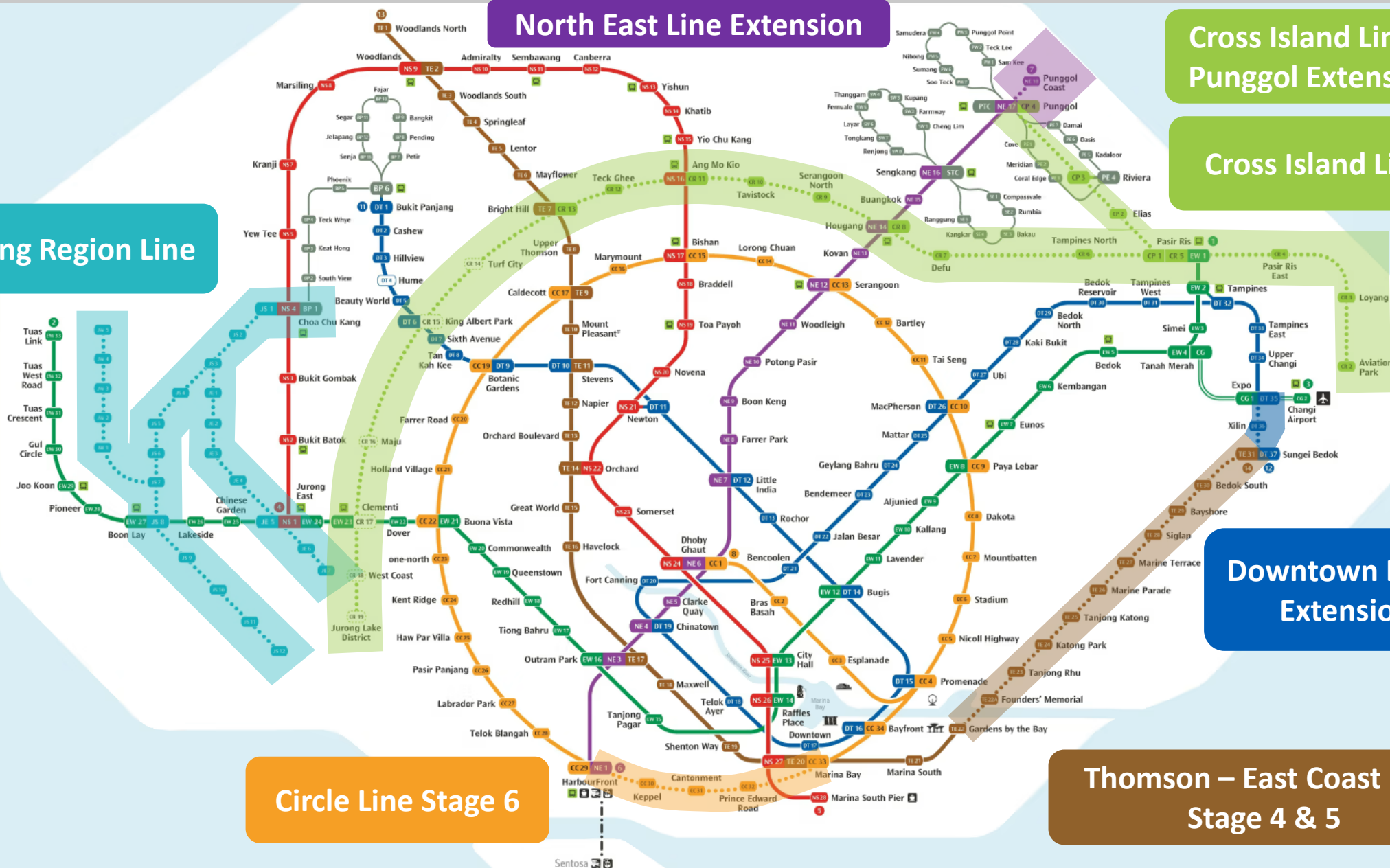
Ongoing Lines

North East Line Extension

Cross Island Line –
Punggol Extension

Cross Island Line

Jurong Region Line



Circle Line Stage 6

Thomson – East Coast Line
Stage 4 & 5

1970

1980

1990

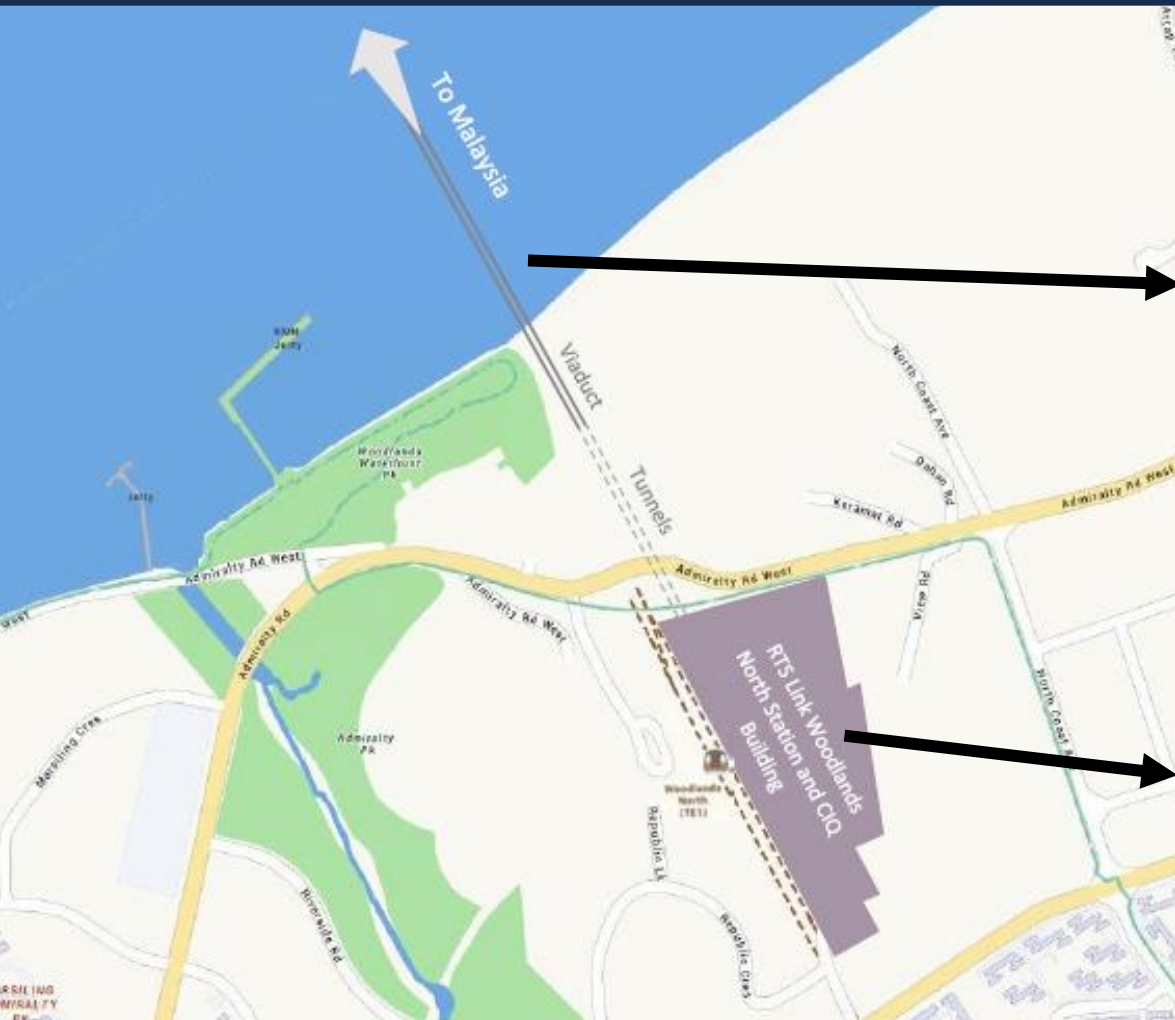
2000

2010

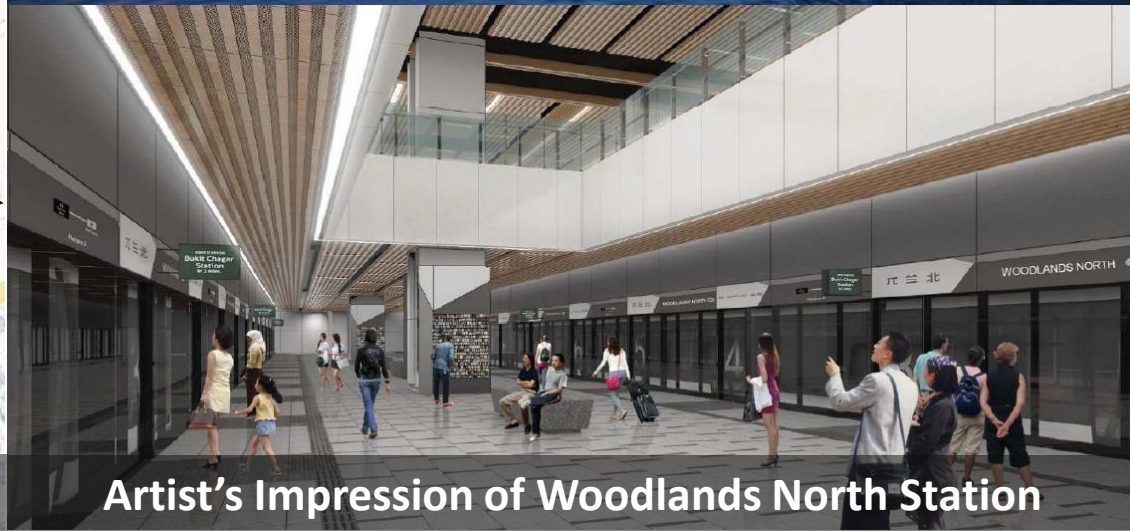
2020

Ongoing Lines

Johor Bahru – Singapore Rapid Transit System Link



Artist's Impression of RTS Link Viaduct



Artist's Impression of Woodlands North Station

1970

1980

1990

2000

2010

2020

Location of RTS Link Woodlands North Station

Future Lines

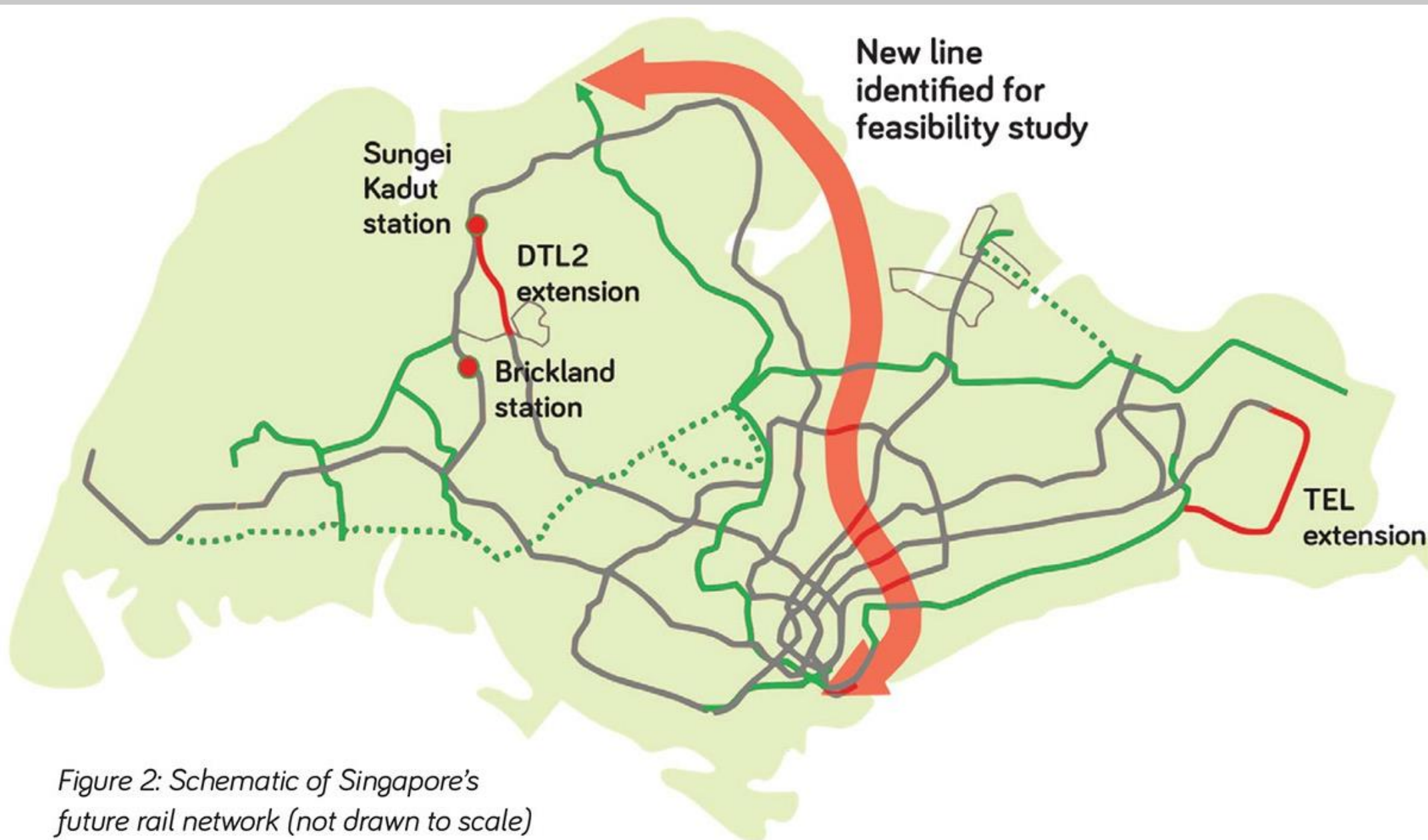


Figure 2: Schematic of Singapore's future rail network (not drawn to scale)

1970

1980

1990

2000

2010

2020

Sustainability

- Climate change poses key threats to land transport system.



Rising Sea Levels



Extreme Weather

1970

1980

1990

2000

2010

2020

Green Strategies

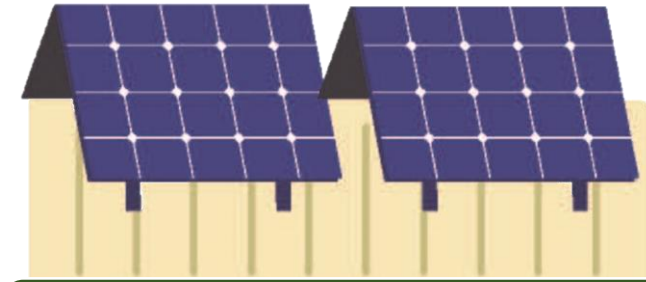
- Developed green strategies to promote sustainability efforts



Green Commutes



Green Opportunities



Green Operations



Green Vehicles



Green Infrastructure



Green Communities

1970

1980

1990

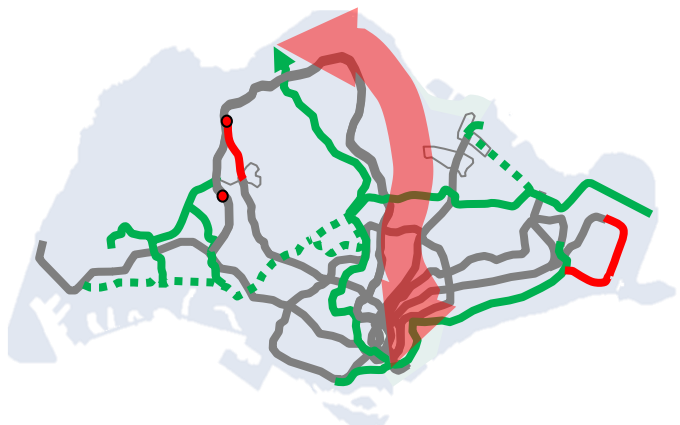
2000

2010

2020

Green Commutes

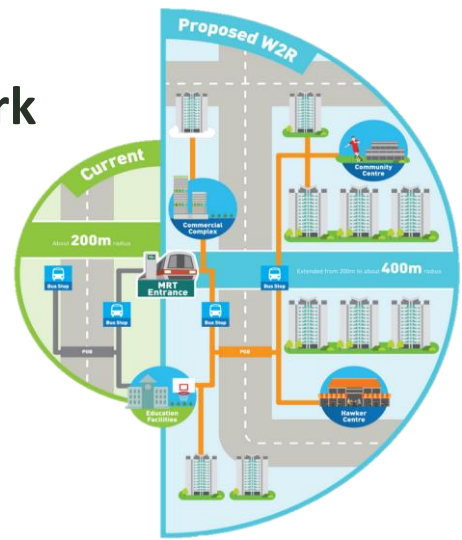
- Encouraging the switch to walking, cycling and taking public transport



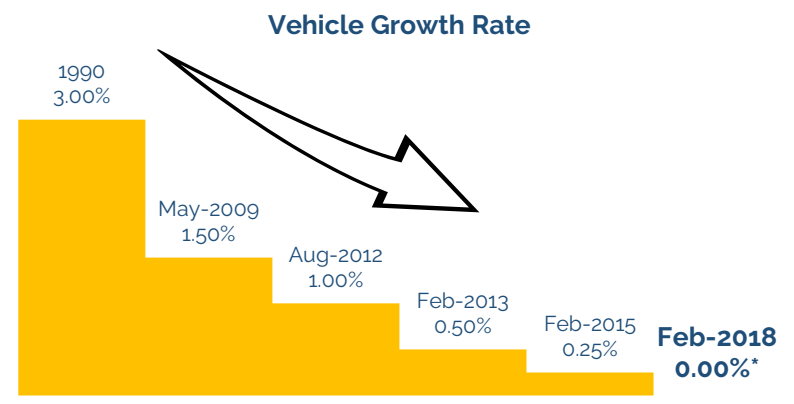
Expansion of rail network to 360km by 2030s



Expansion of cycling network to 1,300km by 2030s



Expansion of sheltered walkway network by 150km by 2040



Deprioritizing Car Ownership

1970

1980

1990

2000

2010

2020

2 Green Opportunities



Image courtesy of Delta Capita

Green Financing
Funding for green projects



Open Innovation
Trial new green technologies

1970

1980

1990

2000

2010

2020

3 Green Operations



Renewable Energy
*Increase deployment of
solar energy*



Optimise Resource Usage
*Improve energy usage in
rail operations*

1970

1980

1990

2000

2010

2020

Digitalization & Automation

- Digitalization and automation are no longer a good-to-have.
- They are a must-have.



1/4

of Singapore's population will
be >65 years old by 2030



Every 12 hours

Knowledge is doubled (compared
to every 13 months in 1982)

1970

1980

1990

2000

2010

2020

Digitalization & Automation

Our Railway Digitalization & Automation Journey

First MRT line
start operations
(Grade of
Automation,
GOA 2)

1987



Bought back
rail assets from
Operators.
O&M data start
to come in

2016



Study into
Depot
Automation
and Common
Data Platform

2023



2003

First fully
automated
MRT line, NEL
(GOA 4)



2021

Study into
Maintenance &
Engineering Centre
(MEC)



2024

Formation of
Rail
Digitalization
Division



1970

1980

1990

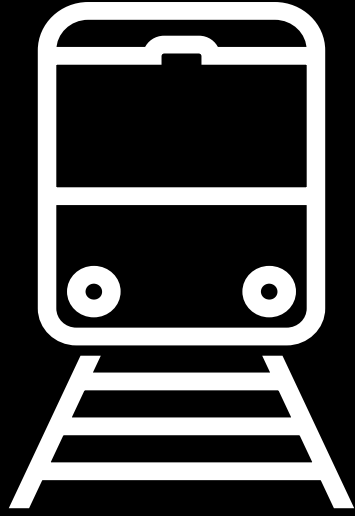
2000

2010

2020

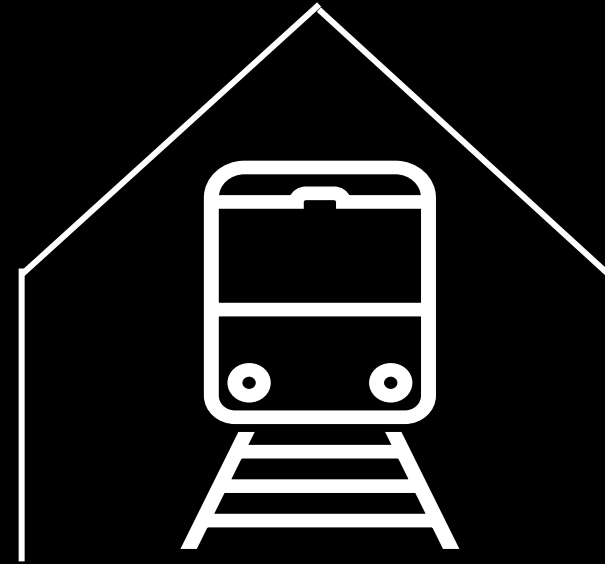
Digitalization & Automation

A multi-team and multi-disciplinary effort...



Digi Train

Standardizing Condition-
monitoring data to be collected
for all train fleets



Digi Depot

Leveraging on
automation to optimize
workflows

1970

1980

1990

2000

2010

2020

THANK YOU



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